INTERRUPTS

UNCLASSIFIED

RISK ASSESSMENT: *Low*

SAFETY CONSIDERATIONS:

Electrical Shock Hazard

Electrostatic Discharge

ENVIRONMENTAL CONSIDERATIONS:

None

TERMINAL LEARNING OBJECTIVE

ACTION: Explain microprocessor interrupt operations.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

ENABLING LEARNING OBJECTIVE

ACTION: Identify the characteristics of interrupts.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

INTERRUPT

A signal to the microprocessor which stops the execution of a running program so that a program of a higher priority can be run.

INTERRUPT

Interrupts are an important part of microprocessor operation.

It allows the processor to operate without having to check external devices or perform certain programs unless required.

ENABLING LEARNING OBJECTIVE

ACTION: Identify the types of interrupts.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

TYPES OF INTERRUPTS

SOFTWARE

HARDWARE

RESET

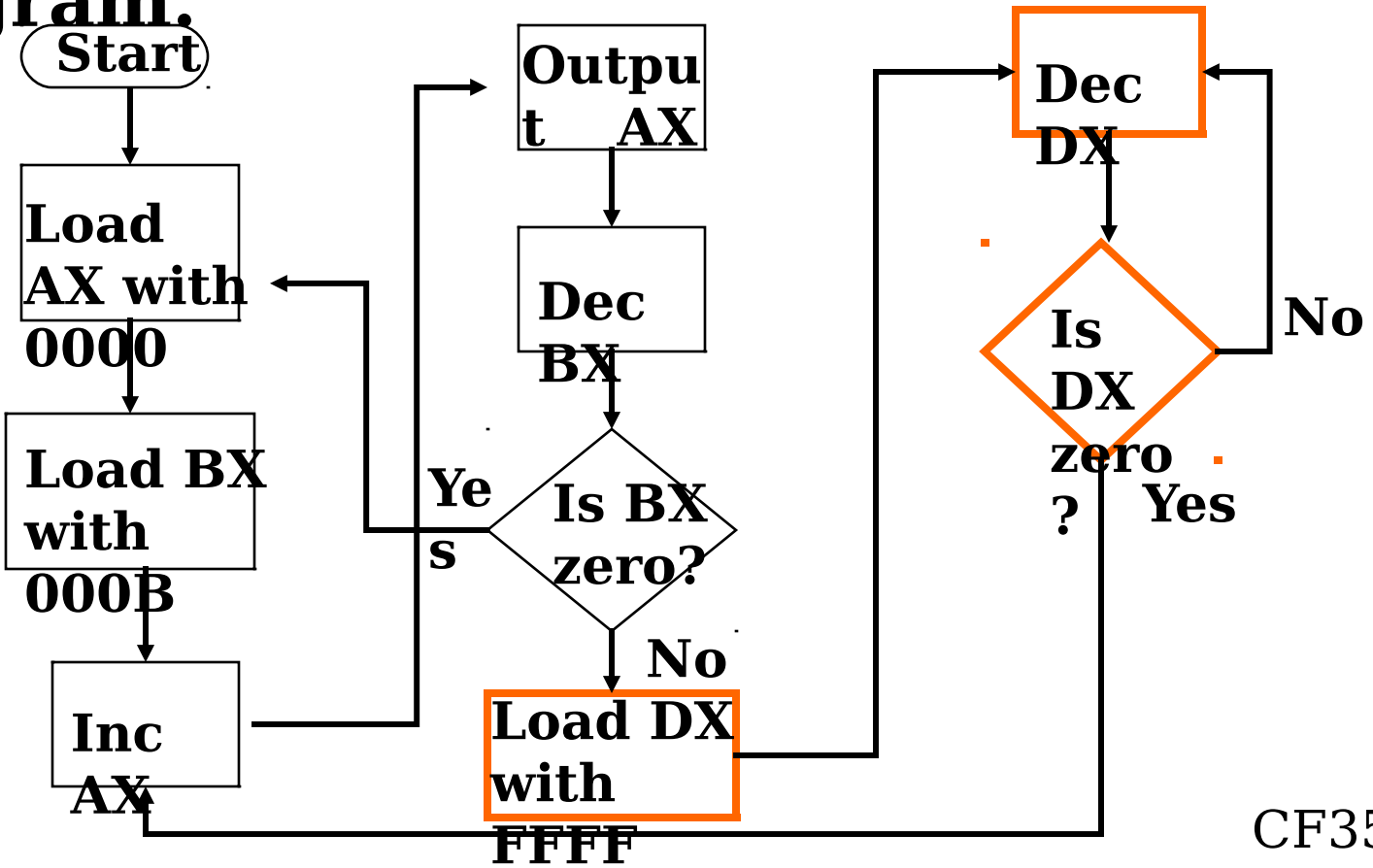
SOFTWARE INTERRUPTS

Instructions placed in a program by the programmer.

When a running program executes an interrupt instruction, the main program is stopped, the secondary program is run, then the main program is continued at the point where it left off.

SOFTWARE INTERRUPTS

An example would be a delay routine used to slow down the execution of a program.



HARDWARE INTERRUPTS

A hardware interrupt is generated by a device that is external to the CPU.

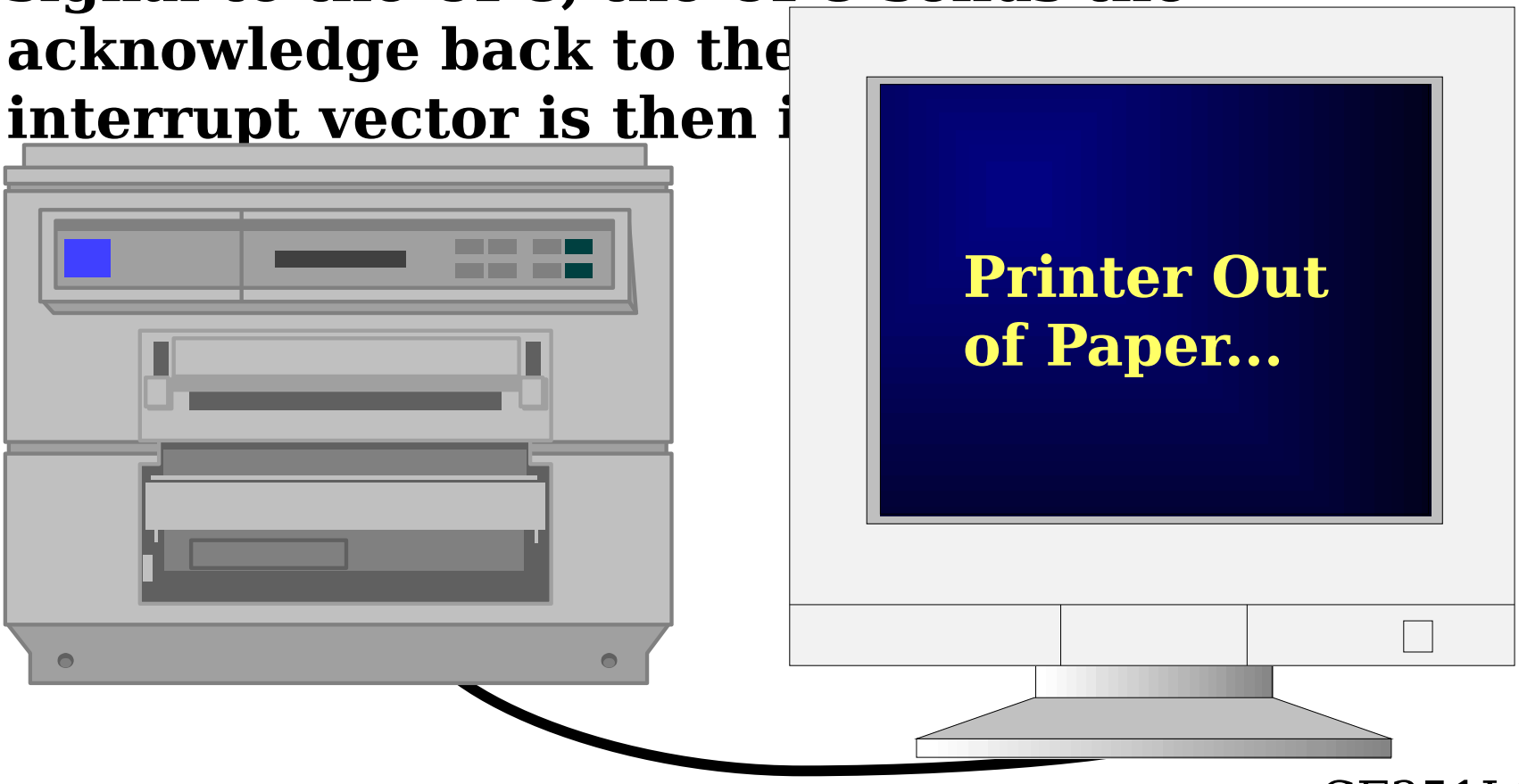
The CPU uses the INT or NMI pins to accept an input that an external device needs to communicate.

Upon receiving the hardware interrupt signal, the CPU stops the current program, goes to another program that services the device, then returns to the main program.

HARDWARE INTERRUPTS

An example would be a printer that runs out of paper. The printer sends a request to the interrupt controller, the controller sends the signal to the CPU, the CPU sends the acknowledge back to the

interrupt vector is then i



RESET INTERRUPT

Stops the microprocessor and returns the system to its initial state.

All registers are cleared or set to a predetermined value as called for by the monitor routine. (segment registers set to 0080).

It stops any looping program or a program that has malfunctioned and has caused the CPU to “freeze up”.

ENABLING LEARNING OBJECTIVE

ACTION: Identify maskable and non-maskable interrupts.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

MASKABLE INTERRUPTS

(INT)

Software - a high sent by the software can be ignored (masked) by the processor. Only when the interrupt enable flag is set will the processor recognize this type of interrupt.

Hardware - some hardware interrupts are sent on this line. If the interrupt enable flag has been set by a software routine the interrupt will be recognized by the processor.

NON-MASKABLE INTERRUPTS

(NMI)

This type of interrupt cannot be masked by the processor. Most hardware interrupts are connected to this line.

When a hardware device fails it sends an interrupt request to the controller which sends the signal on the NMI line. The processor sends an acknowledge back to the controller and the interrupt vector is initiated.

The Reset is a non-maskable interrupt. It doesn’t require the use of the

ENABLING LEARNING OBJECTIVE

ACTION: Identify interrupts vectors.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

INTERRUPT VECTORS

PORTION OF MEMORY SET ASIDE FOR STORAGE OF SERVICE PROGRAMS FOR EACH INTERRUPT

INTERRUPT VECTOR 00h

Points to the Divide by Zero interrupt service routine.

This interrupt is invoked when the user attempts to run a program that tries to divide by zero.

Is this a software or hardware interrupt?

INTERRUPT VECTOR 00h

ANSWER:

SOFTWARE

INTERRUPT VECTOR 01h

This type of interrupt points to the single-step service routine.

This allows the programmer to run a program in the single step mode, i.e. the Trace command.

Is this a software or hardware interrupt?

INTERRUPT VECTOR 01h

SINGLE STEP INTERRUPT

ANSWER:

SOFTWARE

INTERRUPT VECTOR 04h

This interrupt points to the overflow service routine.

When an arithmetic operation has exceeded the capacity of the ALU, this service routine will be invoked.

An indication would be the overflow flag would be set to OV.

INTERRUPT VECTOR 20h

This interrupt points to the program terminate service routine.

This type of interrupt is intentional and is put at the end of a program to stop its execution.

For example: CD 20.

Interrupt Vector

Question: If during the execution of a program the numbers being added by the ALU are more than 16 bits, what service routine will be invoked?

A: Vector 00

B: Vector 01

C: Vector 04

D: Vector 20

Question: If during the execution of a program the numbers being added by the ALU are more than 16 bits, what service routine will be invoked?

A: Vector 00

B: Vector 01

C: Vector 04 ***Overflow***

D: Vector 20

ENABLING LEARNING OBJECTIVE

ACTION: Identify interrupts priorities.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

INTERRUPT PRIORITY

Used for hardware interrupts.

When more than one hardware interrupt occurs, the Priority Resolver determines which interrupt will be serviced first then second etc...

This is done by the Resolver using a programmed algorithm to make each decision.

INTERRUPT PRIORITY

Used for hardware interrupts.

Another method to determine the priority of interrupts is to place the interrupt vectors in the microprocessor memory into groups.

Group #0	Group #1	Group #2
Video Card Fail	Modem Fail	Printer Out of Paper
Memory Read Fail	Sound Card Fail	

The failures in group 0 would be serviced before those in the higher groups.

INTERRUPT PRIORITY

Interrupt priorities are not used for software since you cannot have more than one software interrupt at the same time.

Whether or not a software interrupt is serviced is determined by the software as written by the programmer.

If the Interrupt enable flag is set then the CPU will acknowledge the interrupt.

INTERRUPT PRIORITY

The reset button has the highest priority of all the interrupts.

ENABLING LEARNING OBJECTIVE

ACTION: Identify operations of the interrupts controller.

CONDITIONS: Given a classroom environment, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on system interrupt operations.

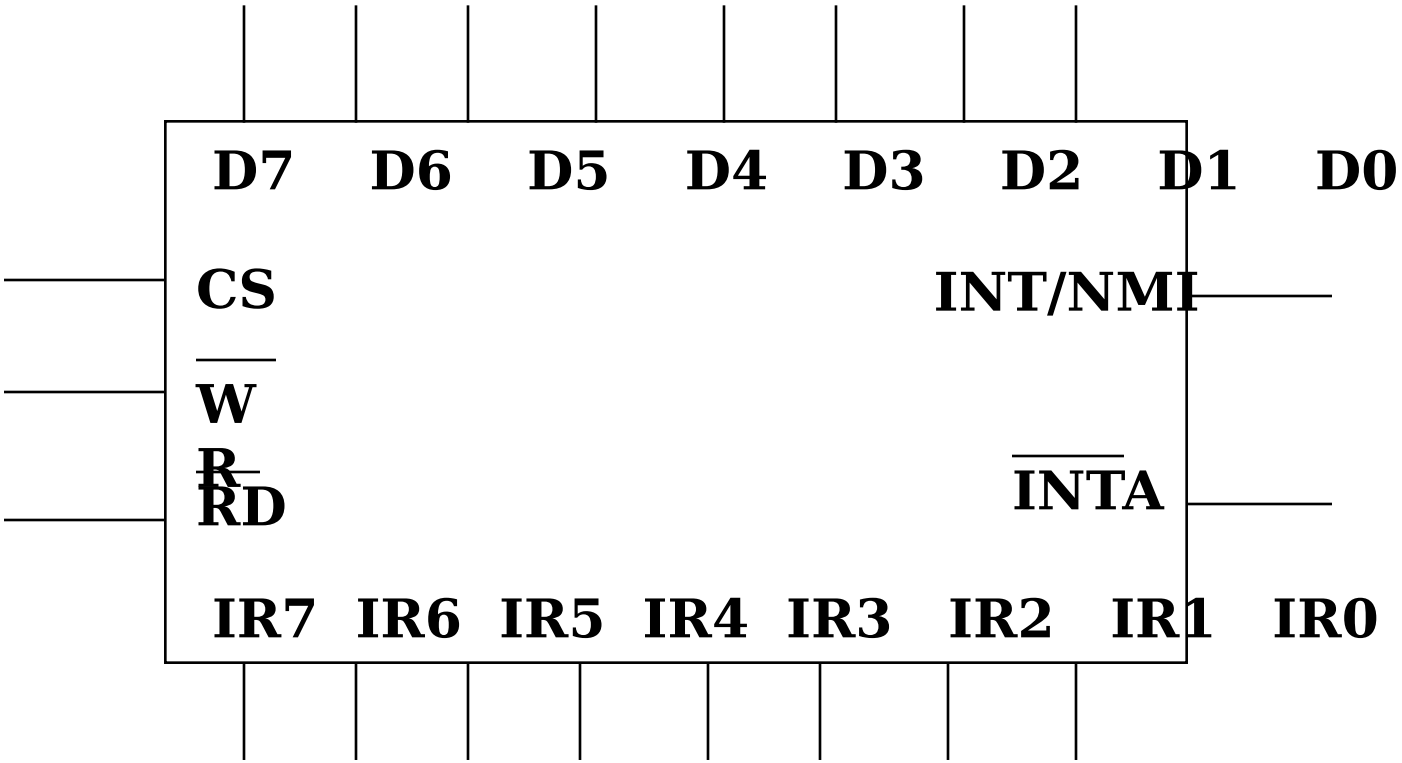
INTERRUPT CONTROLLER

The interrupt controller is used to determine the priority of hardware interrupts.

When more than one hardware interrupt occurs, the interrupt controller determines which will be serviced first. It then sends a high on either the INT or NMI lines to the CPU. The CPU will send back and acknowledge and the controller sends an 8 bit word on the data lines.

The CPU reads this data and sends the appropriate interrupt vector.

PROGRAMMABLE INTERRUPT CONTROLLER



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